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R.W. COWLIN, DIRECTOR

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE

PORTLAND, OREGON

APRIL 1957

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FOREWORD

Forest resources and forest production in the Pacific Northwest can be protected and materially increased by reducing depredations of a relatively few species of forest insects. Prompt detection and reporting of insect-caused damage, plus timely research projects, are the keys to effective and economical control.

The Pacific Northwest Forest and Range Experiment Station is always anxious and willing to assist those interested and concerned with the protection of our forest resources. Reports of insect activity will be welcomed and will receive prompt attention.

Many individuals, agencies, and organizations participated in the 1956 forest insect surveys. Personnel of the Station's Division of Forest Insect Research collected much of the data on insect-caused damage and coordinated all survey data.

Grateful acknowledgement is made to all who participated in the 1956 surveys. Special acknowledgement is made for the information and assistance given by the principal cooperators: the Oregon State Board of Forestry, the Washington State Division of Forestry, and the Weyerhaeuser Timber Company.

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FOREST INSECT CONDITIONS IN THE PACIFIC NORTHWEST--1956

by

J. M. Whiteside
Entomologist

April 1957

Pacific Northwest Forest and Range Experiment Station
Forest Service U. S. Department of Agriculture

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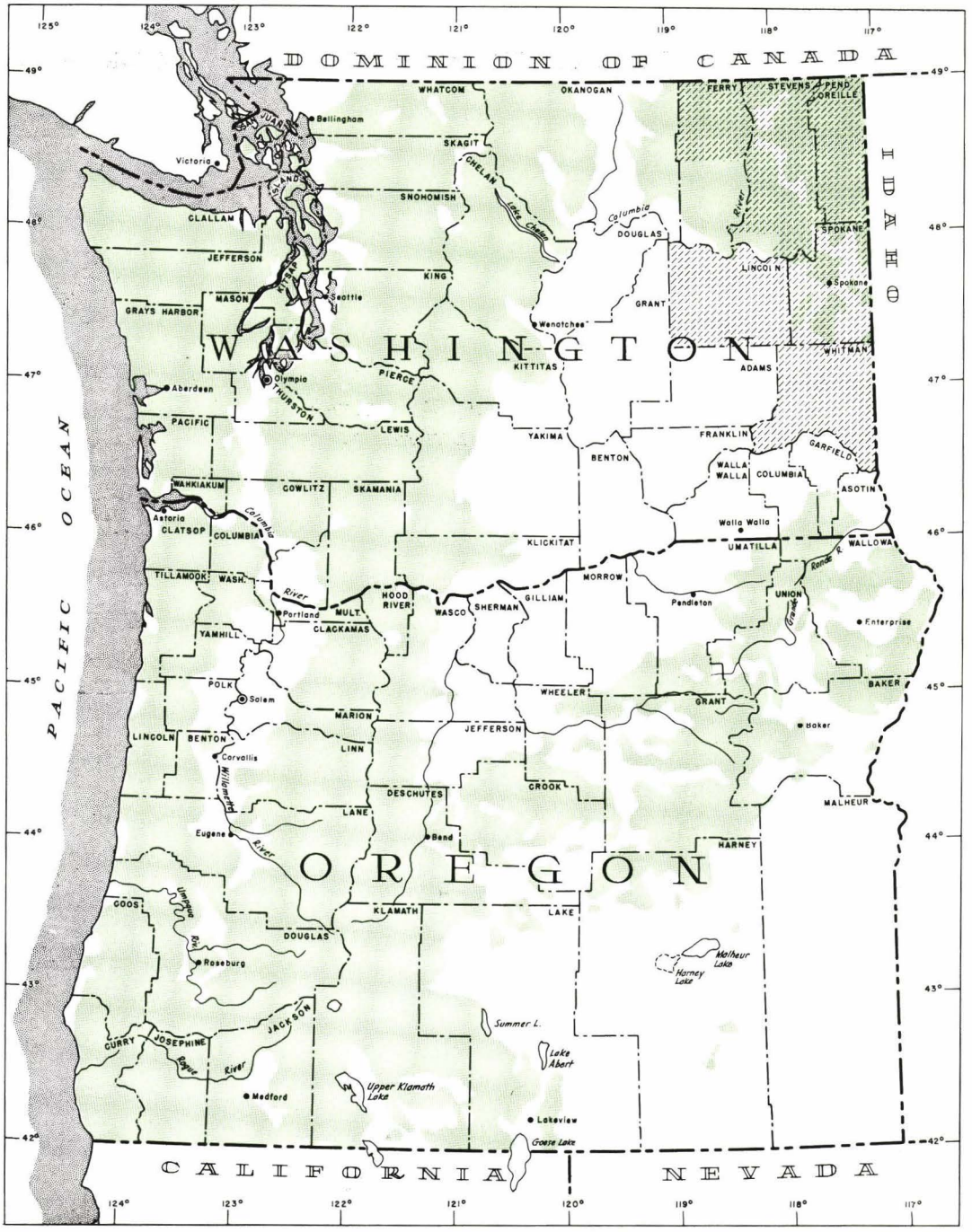
FORESTED AREAS OF OREGON AND WASHINGTON



Areas served by the Pacific Northwest Forest and Range Experiment Station, Portland, Oregon

Areas served by the Intermountain Forest and Range Experiment Station, Ogden, Utah

The Division of Forest Insect Research of the Pacific Northwest Forest and Range Experiment Station conducts and coordinates forest insect research and surveys and gives technical advice on control programs in Oregon and most of Washington. Services for Lincoln, Pend Oreille, Spokane, Whitman and parts of Ferry and Stevens Counties in Washington are available through the Forest Insect Laboratory, Missoula, Montana, a field unit of the Intermountain Forest and Range Experiment Station, Ogden, Utah.

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Terminals of lowland white fir gouted by the balsam woolly aphid, Chermes piceae (Ratz.). The damage caused by this imported pest is of great concern to forest owners and managers in the Pacific Northwest.

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FOREST INSECT CONDITIONS IN THE PACIFIC NORTHWEST--1956

by

J. M. Whiteside

INTRODUCTION

Past losses in tree growth and tree mortality due to forest insects have been responsible for a staggering reduction in our forest resources. However, within the past decade, an awareness of the damage caused by forest pests has brought about significant changes in the field of forest protection. Examples of the modern approach to the important pest problems that concern each of us are: effective federal and state forest pest control laws; cooperative pest action councils composed of representatives of private, state and federal organizations; new insecticides plus effective and economical methods of application; and increases in appropriations and trained personnel for surveys and research in both private and public agencies.

The Pacific Northwest has a total forest land area of 54 million acres, five-sixths of which is classed as commercial forest land. After several decades of heavy utilization, the region still has some 18 million acres of old-growth sawtimber and about 38 percent of the live sawtimber volume in the continental United States. Because the Pacific Northwest furnishes more than one-quarter of all forest products consumed in the United States each year and because more than 250,000 people depend upon the wood-using industries of the region for their direct livelihood, the annual damage caused by insects and other pests is of paramount importance.

Forest insect conditions in the Pacific Northwest in 1956 were evaluated from four primary sources: (1) regional aerial surveys, (2) ground surveys, (3) ground observations by cooperating foresters and entomologists, and (4) insect material submitted to the Station for identification by private and public landowners.

The results of the cooperative survey project in 1956 are presented in this annual report.

Because of their importance to forest owners and managers, the damage caused by bears and the losses of western hemlock from unknown causes are discussed under the heading, "Other Pest Problems in 1956".

SURVEY FINDINGS IN BRIEF

Cooperative surveys revealed a marked improvement in forest insect conditions in 1956 over those prevailing during the past several years. Significant findings of the survey, presented in detail in the following pages, were as follows:

1. There was a reduction in both the acreage and intensity of regionwide insect-caused damage for the third successive year. Epidemic infestations were recorded on 1.4 million acres as compared with 8.2 million, 7.6 million, and 2.2 million acres in 1953, 1954, and 1955, respectively.

2. Nine species of insects were responsible for the 1,410,660 acres of damage (table 1). The damage by each insect on major administrative areas is presented in table 11 for Oregon and table 12 for Washington (see Appendix).

3. Downward infestation trends were recorded for the following major insects:

   a. Spruce budworm damage, while still serious, was at its lowest level since measurements of defoliation were started in 1947.

   b. Douglas-fir beetle outbreaks were at a low level, except on the Colville Indian Reservation.

   c. Western pine beetle damage was at an all-time low.

   d. Silver fir beetle damage in stands of Pacific silver fir has subsided.

4. Upward infestation trends were recorded for the following major insects:

   a. Balsam woolly aphid infestations expanded and tree-killing was intensified.

   b. Mountain pine beetle damage increased, especially in western white pine stands in the Washington Cascades.

   c. Oregon pine ips damage in ponderosa pine sapling and pole stands was found to be much more severe throughout the Blue Mountains area of Oregon.

5. Tree-killing by bears and mortality of western hemlock from unknown causes also increased sharply in western Washington.

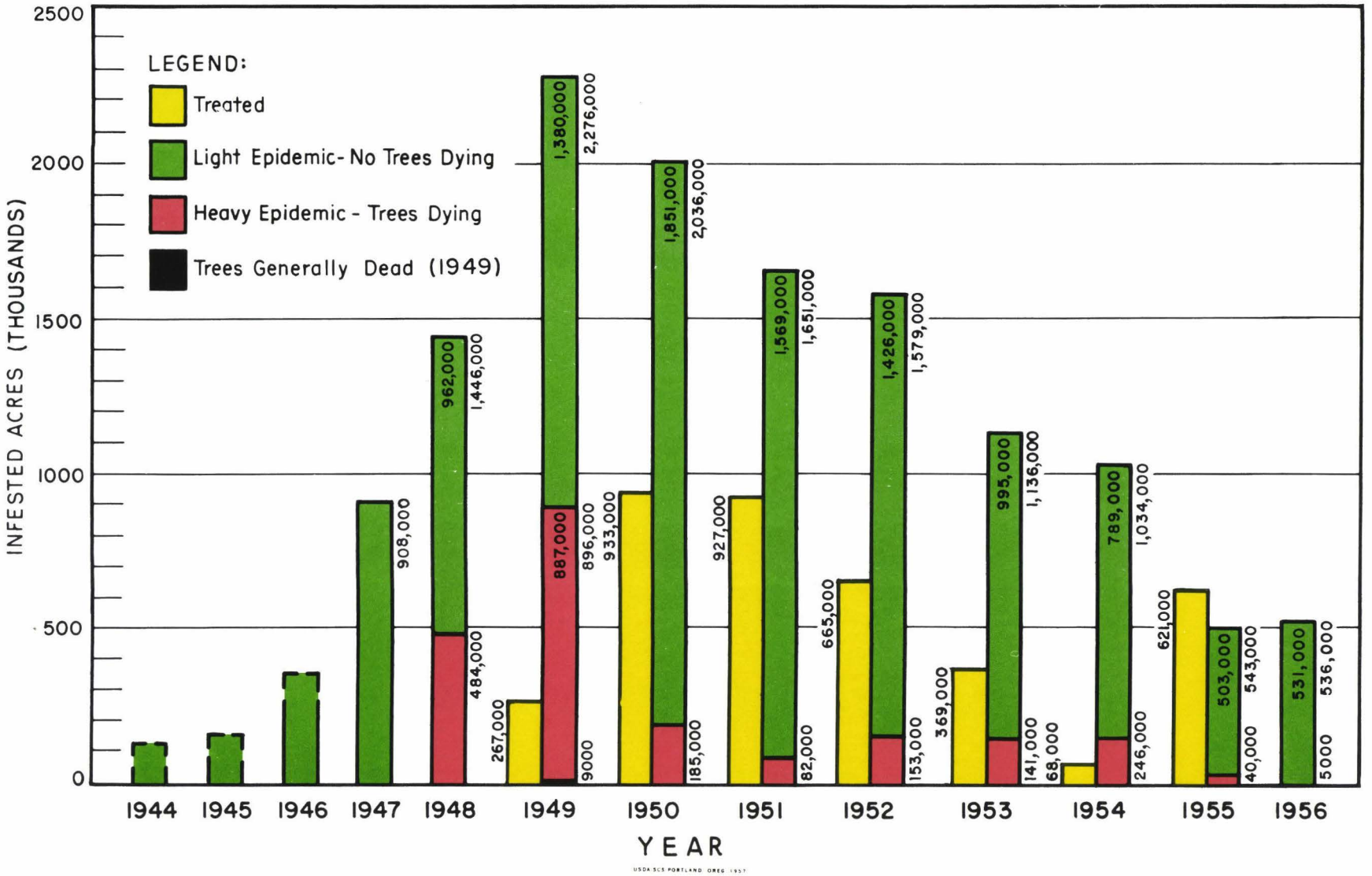
Table 1.--Summary of 1956 forest insect damage in Oregon and Washington 1/

Source of damage	Oregon		Washington		Regional total	
	Infestation centers	Area	Infestation centers	Area	Infestation centers	Area
	No.	Acres	No.	Acres	No.	Acres
Spruce budworm	165	536,120	0	0	165	536,120
Balsam woolly aphid	176	152,210	216	203,780	392	355,990
Mountain pine beetle	164	94,540	245	158,220	409	252,760
Douglas-fir beetle	120	20,770	198	96,130	318	116,900
Oregon pine ips	266	82,720	58	9,220	324	91,940
Fir engraver beetles	58	19,200	13	5,760	71	24,960
Western pine beetle	60	13,920	11	2,110	71	16,030
Englemann spruce beetle	25	11,160	13	3,720	38	14,880
Larch budworm	0	0	3	1,080	3	1,080
All insects	1,034	930,640	757	480,020	1,791	1,410,660
Damage by defoliators	165	536,120	3	1,080	168	537,200
Damage by bark beetles	693	242,310	538	275,160	1,231	517,470
Damage by sucking insects	176	152,210	216	203,780	392	355,990
All insects	1,034	930,640	757	480,020	1,791	1,410,660

1/ Except northeastern counties of Washington.

FIGURE 1

PROGRESS OF SPRUCE BUDWORM EPIDEMIC IN OREGON AND WASHINGTON 1944-56

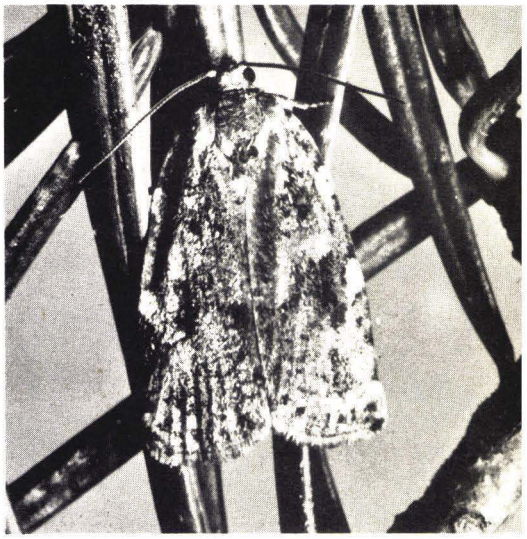


SPRUCE BUDWORM

Choristoneura fumiferana (Clem.)

The present spruce budworm epidemic in the Pacific Northwest started in 1944 and is still in progress (fig. 1).

Protection of the Douglas-fir and true fir forests of Oregon and Washington from destruction by the budworm has been successfully accomplished by a timely, cooperative aerial spraying program. This program, based on the results of detailed aerial and ground surveys and research findings, and recommended by the Northwest Forest Pest Action Council, has controlled the budworm in the more valuable stands and heavier centers of infestation from 1949 to 1955. During this 7-year period, 3,839,611 acres have been treated at a cost of $4,045,000, or about $1.05 per acre.



Spruce budworm adult x4.

Mature spruce budworm larva x4.

Situation in 1956

No aerial spraying was undertaken in the region in 1956. Suspension of control was recommended by the Action Council because of reduced acreage of "heavy epidemic" infestations, marked downward trend of the infestation, and noticeable increases in the effectiveness of natural control factors.

Results of the current spruce budworm surveys in the Pacific Northwest show that the calculated risk of not spraying in 1956 turned out well. The acreage of epidemic infestations dropped from 542,430 acres in 1955 to 536,120 acres in 1956; intensity of the damage on most units was in the "light epidemic" category; no appreciable tree-killing by the budworm occurred; and natural control factors, particularly parasites, increased in effectiveness over the levels observed during 1955. An exception to the favorable regional downward trend was found in the central Blue Mountains of Oregon where infestations increased both in extent and intensity.

For the first time since 1944, there were no epidemic infestations of the budworm recorded in Washington. All 1956 infestations were in the Blue Mountains area of Oregon (table 2 and fig. 3).

Table 2.--Intensity of spruce budworm infestations in 1956, by administrative areas 1/.

Administrative areas	Intensity of infestations			Total infestations
	Light	Moderate	Heavy	
	Acres	Acres	Acres	Acres
Malheur N. F.	209,520	19,460	0	228,980
Ochoco N. F.	19,360	840	0	20,200
Umatilla N. F.	25,600	23,680	3,280	52,560
Wallowa-Whitman N. F.	212,700	19,500	0	232,260
Lookout Mt. (Baker Co.)	0	120	2,000	2,120
All areas	467,180	63,660	5,280	536,120

1/ Areas include infestations on federal, private and state lands.

In keeping with past practices, the current infestations have been separated into logical control units (fig. 3). Sixteen units were established in 1956 in the Blue Mountains area. The intensity of defoliation and broad ownership classes in each unit are given in table 3. Thus, 87.1 percent of the current budworm damage was classified as "light epidemic", and 92.3 percent of the infested acreage was federally owned.

The Spruce Budworm Committee made its regular yearly inspection trip during the period October 8-10, 1956 to evaluate the current situation. Inspections of survey findings were made and discussions were held with local groups concerned with the problem.

The Pest Action Council reviewed the survey findings and the report of the Spruce Budworm Committee at its annual meeting in Portland, Oreg. on October 29, 1956. The members unanimously voted: that aerial spraying operations be suspended in 1957 for the second successive year and that provisions be made for a control project in the central Blue Mountain, Oregon area in 1958. Accordingly, no spruce budworm control project will be undertaken in the Pacific Northwest in 1957, but the Oregon State Board of Forestry and U. S Forest Service were advised that a control project might be necessary in 1958 on approximately 400,000 acres in the following units: Aldrich Mt., Strawberry Mt., Dixie Butte, Silver Butte, and Sumpter (table 3 and fig. 3).

Table 3.--Intensity of spruce budworm infestations in the Blue Mountains, Oregon area in 1956, by control units and ownership classes [1/]

Area and unit	Intensity of infestations						Total infestations		Ownership classes		
	Light		Moderate		Heavy				Federal	Other	Total
	Acres	Percent	Acres	Percent	Acres	Percent	Acres	Percent	Percent	Percent	Percent
1. Rocky Butte	1,920	69.6	840	30.4	0	0	2,760	100	75.4	24.6	100
2. Round Mt.	1,440	100.0	0	0	0	0	1,440	100	100.0	0	100
3. Brush Creek	4,960	100.0	0	0	0	0	4,960	100	100.0	0	100
4. Snow Mt.	14,720	100.0	0	0	0	0	14,720	100	72.8	27.2	100
5. King Mt.	3,920	100.0	0	0	0	0	3,920	100	89.8	10.1	100
6. Aldrich Mt.	63,980	99.5	320	.5	0	0	64,300	100	87.8	12.2	100
7. Strawberry Mt.	107,120	91.1	10,420	8.9	0	0	117,540	100	85.9	14.1	100
8. Dixie Butte	26,400	84.9	4,680	15.1	0	0	31,080	100	97.2	2.8	100
9. Silver Butte	96,960	78.2	23,680	19.1	3,280	2.7	123,920	100	97.8	2.2	100
10. Sumpter	19,400	100.0	0	0	0	0	19,400	100	90.1	9.9	100
11. Bald Ridge	10,800	75.8	3,440	24.2	0	0	14,240	100	99.7	.3	100
12. Lookout Mt.	0	0	120	5.6	2,000	94.4	2,120	100	9.4	90.6	100
13. Pine Creek	35,360	98.6	480	1.4	0	0	35,840	100	92.0	8.0	100
14. Moss Spring	13,920	65.4	7,360	34.6	0	0	21,280	100	100.0	0	100
15. Joseph	23,400	100.0	0	0	0	0	23,400	100	97.8	2.2	100
16. Snake	42,880	77.6	12,320	22.4	0	0	55,200	100	98.2	1.8	100
All areas	467,180		63,660		5,280		536,120				
Average (wtd.)		87.1		11.9		1.0		100	92.3	7.7	100

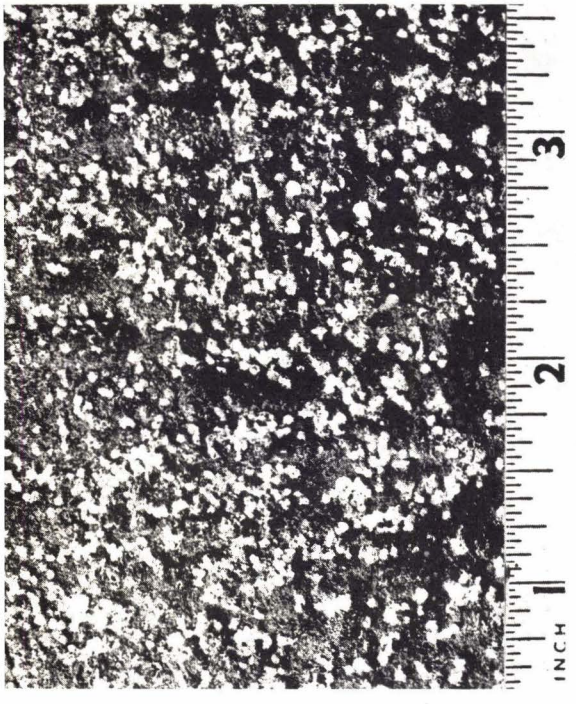
1/ The division of infestations by ownerships is based on rough computations and is therefore approximate.

Since the start of the present epidemic, the spruce budworm has been known to exist in extensive areas in populations too light to be detected by aerial surveys. Data on these potential sources of infestation have been secured through annual cooperative ground surveys organized in 1949. From 1953 to 1955, 360 plots, each with 10 tagged trees, have been examined annually by cooperators.

Because of the improved budworm situation and suspension of control operations, it was decided that no regularly scheduled ground-plot examinations were needed by cooperators in 1956. However, to maintain a check on endemic budworm populations on the Mount Hood and Willamette National Forests and the Warm Springs Indian Reservation, Station personnel recruised 42 plots on these forests during the period June 20-July 2, 1956. Budworm larvae were present in light numbers on 9 plots and were absent on 33 plots.

The annual re-examination of trend plots on sprayed areas in both eastern and western Oregon by Station personnel showed a continuation of very light budworm populations, measuring 0 to 20 specimens per 100 fifteen-inch twigs during the bud-feeding period. In all cases, the total number of associated bud-feeders, chiefly species of little or no economic importance, exceeded the number of spruce budworm recovered on each plot.

The present low incidence of budworm populations on treated areas is most gratifying and shows that natural factors are continuing to keep this important pest in check.



Woolly exudation typical of chermes bole infestations.

BALSAM WOOLLY APHID
Chermes piceae (Ratz.)

The balsam woolly aphid has been known as a serious pest of grand fir in Oregon since 1930. However, its was not until 1954 that extensive damage to other species of Abies became evident. Pacific silver fir and subalpine fir are being attacked and killed in both Oregon and Washington. In fact, tree-killing by this introduced aphid has reached alarming proportions, particularly in the Washington Cascades.

Epidemic infestations increased from 294,560 acres in 1955 to 355,990 acres in 1956. Likewise, the severity of the attacks has increased, especially on Pacific silver fir. The distribution and intensity of the current damage, by administrative areas, is shown in table 4.

The most serious damage in 1956 (173,260 acres) occurred in the drainages of Toutle, Lewis and Green Rivers in the Mount St. Helens area of southwestern Washington (fig. 4). In the older centers of infestation in this area, tree mortality is high and likely to continue for several years. Salvage logging operations have been started but need to be greatly accelerated.

Close-up of chermes adults and eggs under woolly exudation x40.

Table 4.--Intensity of balsam woolly aphid damage in 1956, by administrative areas 1/

Administrative areas	Intensity of damage				Total infestations
	Light	Moderate	Heavy	Very heavy	
	Acres	Acres	Acres	Acres	Acres
Oregon					
Deschutes N.F.	960	1,320	2,240	960	5,480
Mt. Hood N.F.	10,120	9,820	2,660	320	22,920
Siuslaw N.F.	7,360	3,680	2,560	3,360	16,960
Umpqua N.F.	360	0	0	0	360
Willamette N.F.	39,240	25,430	39,580	1,600	105,850
Warm Springs I.R.	480	0	0	0	480
N. W. Oregon	160	0	0	0	160
Oregon areas	58,680	40,250	47,040	6,240	152,210
Washington					
G. Pinchot N.F.	63,040	43,040	45,760	21,420	173,260
Mt. Baker N.F.	640	0	0	0	640
Snoqualmie N.F.	0	0	2,040	1,920	3,960
Olympic N.P.	160	0	0	0	160
Mt. Rainier N.P.	160	0	0	0	160
S. W. Washington	23,840	1,760	0	0	25,600
Washington areas	87,840	44,880	47,800	23,340	203,780
All areas	146,520	85,050	94,840	29,580	355,990

1/ Areas include infestations on federal, private and state lands.

Six plots of 100 tagged trees each, established in 1954 in the Mount St. Helens area by the Weyerhaeuser Timber Company and the Station, have been examined annually to follow tree mortality. The rate of tree mortality has been quite variable on these plots with from 2 to 28 percent of the basal area killed in three years. Twelve additional plots of 50 tagged trees each were established by Weyerhaeuser in 1956 to further research studies on this important pest.

In Oregon, the balsam woolly aphid problem is acute in stands of Abies on and adjacent to the Willamette, Mount Hood, and Siuslaw National Forests. With the exception of severe attacks in Pacific silver fir stands in Polk and Lincoln Counties, much of the damage is occurring in stands of subalpine fir below sawtimber size.

The chermes situation is now the number one forest insect problem confronting owners and managers in the Pacific Northwest. In order to stimulate and coordinate action and find answers to the perplexing questions of living with or controlling the balsam woolly aphid, a Chermes Committee of the Pest Action Council has been organized.

Three urgent needs, each involving a variety of activities, are recognized by the Committee. Briefly, they are:

1. Surveys - detect and appraise the infestations, determine the location and amount of dead timber, and ascertain the trend of the epidemic.

2. Salvage - increase salvage efforts, develop increased markets for "white fir", and solve the access road and fire hazard problems.

3. Research - improve survey methods, determine longevity and deterioration rates of attacked trees, expand studies on the habits of the aphid, develop control and management methods for harvesting the affected trees and stands and insuring a new crop.

Considerable progress has been made on this problem through cooperative work. Efforts toward meeting all three major needs are rapdily expanding.

MOUNTAIN PINE BEETLE
Dendroctonus monticolae Hopk.

Outbreaks of the mountain pine beetle in 1956 covered 252,760 acres in 409 centers of infestation (fig. 4) as compared with 174,940 acres and 295 centers in 1955. Three species of pine were attacked and killed: lodgepole, ponderosa, and western white pine. While tree-killing in each species increased in 1956 over that recorded the previous year, heaviest damage has been in western white pine (table 5).

Salvage of infested trees of each species should be encouraged on all damaged areas.

Mountain pine beetle egg and larval galleries and pupal cells on inner bark of ponderosa pine.

Infestations in Western White Pine Stands

In most western white pine stands, trees killed by the mountain pine beetle were also infected with blister rust. This combination of disease and beetles is rapidly eliminating western white pine from our forests. The largest concentration of damage (71,040 acres) was found on the Gifford Pinchot N. F., with the major centers recorded in the Wind River and Lewis River drainages.

Table 5.--Extent of mountain pine beetle damage in 1956, by host species

Host species	Oregon	Washington	Regional total
	Acres	Acres	Acres
Western white pine	34,680	130,180	164,860
Lodgepole pine	52,420	28,040	80,460
Ponderosa pine	7,440	0	7,440
All species	94,540	158,220	252,760

Infestations in Lodgepole Pine

The older centers of infestation in lodgepole pine continued but declined slightly in area and intensity due to decreased host material. In many stands practically all susceptible trees will be gone in another year or two. This was expecially noticeable in the centers around Wanoga Butte on the Deschutes N. F. and Buck Lake and Desolation Swamp on the Rogue River N F. in Oregon and the Chiwawa River drainage on the Wenatchee N. F. in Washington.

On the Deschutes N. F., two new outbreaks in lodgepole pine in the Tumalo River drainage are of special concern. One center is at Jack Pine Spring and the other near Triangle Hill. These centers could be the foci for sizeable infestations in the large areas of lodgepole pine surrounding them.

On the Rogue River N. F. a light epidemic infestation in lodgepole pine in the Sand Creek drainage appears to be increasing and now joins a similar infestation in the Wheeler Creek drainage inside Crater Lake National Park.

On the Malheur N. F. all infestations in lodgepole pine present in 1955 continued aggressively in 1956. These infestations are likely to continue until most of the susceptible-sized lodgepole pine in those limited stands is killed.

Infestations in Ponderosa Pine

Severe killing of young ponderosa pine in 1956 was noted on the Wallowa-Whitman, Umatilla, and Fremont National Forests. Less serious killing was observed on the Deschutes, Rogue River and Umpqua National Forests.

Infestations were most severe in the North Powder River Valley on the Wallowa-Whitman N. F. where killing has been in progress for the past 9 or 10 years. Dense mixed stands became established following land clearing for mining and other purposes. As a result of stand pressures, the intolerant ponderosa pine is being eliminated by the mountain pine beetle.

On the Umatilla N. F. dense pole-sized stands near Hilgard are being killed by a combination of mountain pine beetle and Oregon pine engraver beetle attacks.

DOUGLAS-FIR BEETLE

Dendroctonus pseudotsugae Hopk.

Epidemic infestations of the Douglas-fir beetle continued to decline from a peak of 5,071,750 acres in 1954 to 116,900 acres in 1956. On many forests, infestations were nearly at the vanishing point.

The only large current outbreak continues on the Colville Indian Reservation (table 6 and fig. 4). While this epidemic also declined in area and intensity, severe losses occurred in the main centers on Gold, Nine Mile and Wilmont Creeks and on Whitestone Ridge. Good progress is being made in salvage logging operations in the more accessible centers.

Douglas-fir beetle x8 and galleries on inner bark surface of Douglas-fir.

In the older areas of the 1951-52 blowdown and subsequent beetle-kill in western Oregon and Washington, salvage operations are continuing at a diminishing rate because many of the stands containing dead and down trees have been salvaged. At present, salvage operations have no biological significance.

Probably the largest remaining accessible concentrations of salvable material are in the Smith River and Siuslaw River drainages. The Bureau of Land Management reports that 374 million board feet of blowdown and beetle-killed timber remain to be salvaged in that area. Much of this timber has been too scattered for immediate salvage; however, the completion of 92 miles of access roads in the area early in 1957 will make maximum salvage possible.

Table 6.--Intensity of Douglas-fir beetle damage in 1956, by administrative areas 1/

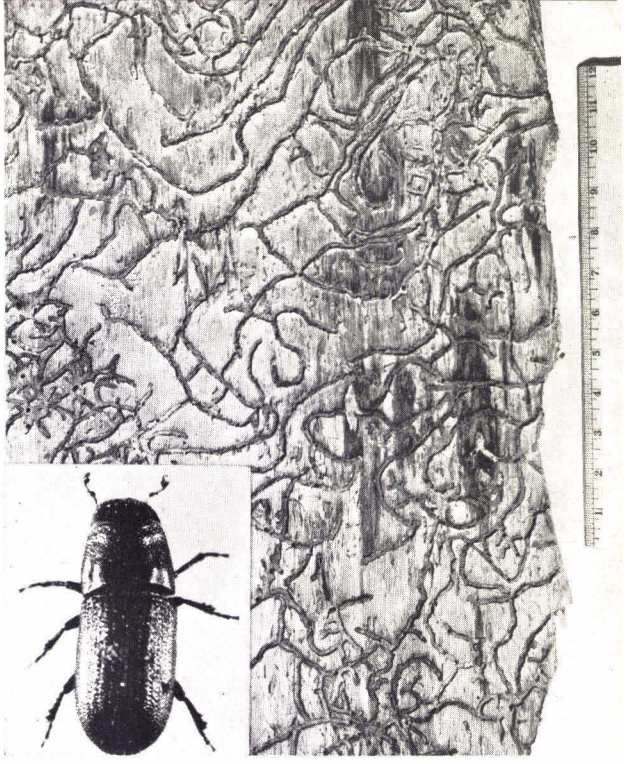
Administrative areas	Total infestations	Intensity of damage				
		Light	Moderate	Heavy	Very heavy	Total
	Acres	Percent	Percent	Percent	Percent	Percent
Oregon						
Wallowa-Whitman N.F.	4,960	35.5	16.1	6.5	41.9	100
Siskiyou N.F.	3,660	91.3	8.7	0	0	100
Siuslaw N.F.	3,400	97.6	2.4	0	0	100
Rogue River N.F.	2,650	100.0	0	0	0	100
Umatilla N.F.	1,560	100.0	0	0	0	100
Coos Bay District	1,520	100.0	0	0	0	100
Mt. Hood N.F.	1,240	100.0	0	0	0	100
Warm Springs I.R.	1,240	100.0	0	0	0	100
Umpqua N.F.	300	100.0	0	0	0	100
Willamette N.F.	160	100.0	0	0	0	100
Deschutes N.F.	80	100.0	0	0	0	100
Oregon areas Average (wtd.)	20,770	82.7	5.8	1.5	10.0	100
Washington						
Colville I.R.	66,540	37.1	43.2	18.7	1.0	100
Okanogan N.F.	16,960	58.5	41.5	0	0	100
Wenatchee N.F.	5,280	100.0	0	0	0	100
Snoqualmie N.F.	3,440	34.9	55.8	9.3	0	100
Spokane I.R.	3,310	4.5	95.5	0	0	100
Yakima I.R.	320	0	100.0	0	0	100
Umatilla N.F.	160	100.0	0	0	0	100
Glenwood District	120	0	100.0	0	0	100
Washington areas Average (wtd.)	96,130	43.0	43.0	13.3	0.7	100
All areas Average (wtd.)	116,900	50.1	36.4	11.2	2.3	100

1/ Areas include infestations on federal, private and state lands.

WESTERN PINE BEETLE

Dendroctonus brevicomis Lec.

Tree-killing by the western pine beetle was at an all-time low in 1956. The survey recorded only 16,030 acres of damage, most of which was in the Rogue River and Applegate River drainages on the Rogue River N. F. On most other forests, losses were very light, consisting of trees scattered singly over wide areas.



Western pine beetle x8 and galleries on inner bark of ponderosa pine.

Recruises of the remaining 320-acre virgin check plots in the region substantiated the low level of western pine beetle loss. However, late in the year a slight increase in beetle populations was noted in portions of the region. It is expected that a slightly higher level of damage will be recorded in 1957.

Salvage of dead and currently infested trees and removal of high risk trees before they are attacked by the beetles has been recommended and continues to be a basic part of regional cutting practices.

ENGELMANN SPRUCE BEETLE

Dendroctonus engelmanni Hopk.

Outbreaks of the Engelmann spruce beetle were found on 38 centers covering 14,880 acres. This compares with 41 centers and 22,580 acres in 1955.

The largest concentration of damage in 1956 was on the Wallowa-Whitman N. F., where aggressive centers of infestation developed in spruce stands--probably from windthrown timber--at the headwaters of the North Fork of the John Day River. Salvage operations have been started in this area.

The older centers of infestation, in the Tollgate area of the Umatilla N. F. and Pinegrass Ridge on the Snoqualmie N. F., have died out. A few newly-killed trees were evident in the old center on the American River on the Snoqualmie N. F., but this infestation is almost at an end.

Galleries of the Oregon pine ips on inner bark of ponderosa pine.

OREGON PINE IPS

Ips oregoni (Eichh.)

Populations of the Oregon pine ips periodically increase to tremendous numbers and aggressive attacks are made on healthy living trees. Entomologists refer to these as "Ips years". 1956 was such a year.

Current surveys recorded 324 centers of Ips damage covering 91,940 acres (fig. 4) as compared with 111 centers and 51,910 acres in 1955. The bulk of the damage was found in the Blue Mountains area of Oregon. Group killing of young growth was extensive and severe, especially where logging occurred in fringe-type stands.

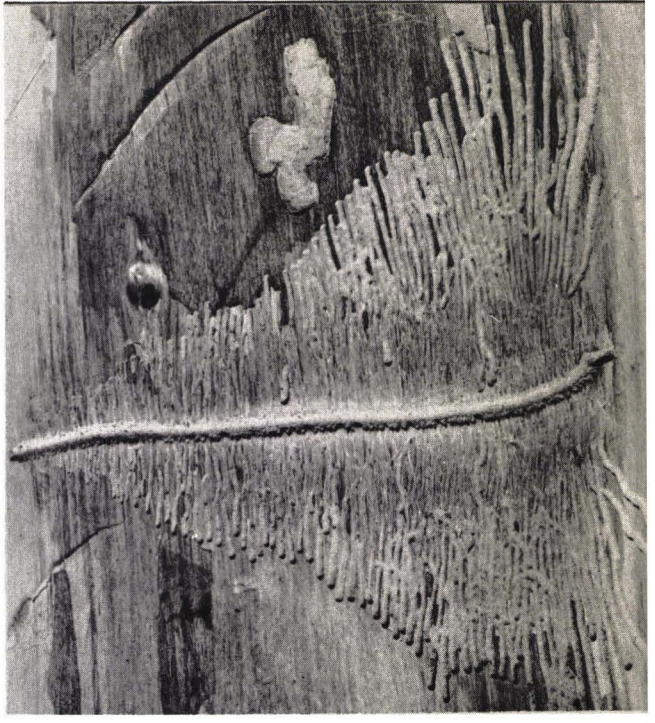
Some 37,280 acres of Ips damage were recorded on the Wallowa-Whitman N. F. where pronounced infestations occurred on Dooley Mountain and near Baker. On the Ochoco N. F. tree-killing was found on many parts of the forest, with the severest damage around Grizzly Mt. On the Malheur N. F. Ips activity increased in the John Day Valley and infestations were especially severe around Black Butte, where nearly complete killing of reproduction occurred over large areas. On the Umatilla N. F. the largest concentrations of damage were near Ukiah.

No control is warranted. Improving the methods of slash disposal and varying the time of felling and thinning should help reduce damage in residual stands.

FIR ENGRAVER BEETLES
Scolytus spp.

Killing of subalpine fir by fir engraver beetles, particularly *Scolytus ventralis* Lec., was found on 71 centers covering 24,960 acres. This compares with 89 centers and 50,520 acres in 1955.

The largest centers were on the Umatilla and Wallowa-Whitman National Forests. In the vicinity of Langdon Lake on the Umatilla N. F. the infestation has been present for several years and is continuing at low to moderate levels. A root-rot which predisposes many of the trees to attack complicates the infestation.



Egg and larval galleries of *S. ventralis* on wood surface of Shasta red fir.

No control of these beetles is warranted.

LARCH BUDWORM
Zeiraphera griseana (Hubner)

Three centers of light damage to western larch by the larch budworm were observed in the eastern Washington Cascades in 1956. One center of 800 acres was on the Snoqualmie N. F. and two centers of 280 acres on the Colville Indian Reservation. In addition, ground surveys showed the larch budworm to be common on Douglas-fir in the Eugene, Oreg. area sprayed for spruce budworm in 1949, and in both sprayed and unsprayed areas in eastern Oregon. At the existing light intensity, the damage to Douglas-fir buds was not conspicuous, either from the air or on the ground. No control is warranted.

P. granulatus x5 and galleries on inner bark surface of white fir.

SILVER FIR BEETLES

Pseudohylesinus spp.

There were no epidemic infestations of silver fir beetles, Pseudohylesinus grandis Sw. and P. granulatus (Lec.), in Pacific silver fir for the first time in 10 years. Only a few widely scattered, red-topped trees were observed during the survey. In no case was the infestation sufficient to warrant mapping any centers of damage.

The epidemic, which started in 1947, reached a peak in 1954 when 652,230 acres of damage were recorded. In 1955, the trend turned sharply downward and only 114,720 acres were recorded. Most of the tree-killing has been in the Mount Baker area of northwestern Washington.

Salvage of dead and distressed timber has been the only action recommended. An evaluation of a special cooperative survey 1/ showed that nearly 2 billion board feet of timber in the mixed-fir forests of western Washington needed salvage by 1954. By 1956 some 160 million board feet, over 12 percent of the distressed volume, had been removed. Salvage operations are planned for several years because of the importance of Pacific silver fir to the timber and paper and pulp industries of the Pacific Northwest.

Even though the current epidemic has subsided, the work of the Silver Fir Beetle Committee of the Pest Action Council will be continued. The Station will coordinate research and survey projects now under way. Records on three types of plots will be maintained: 296 mortality trend plots, examined by cooperators, will be re-checked until 1960; 50 beetle-host relationship plots will be re-examined by the Station and the data summarized; and 131 trees tagged to study the relationship between Pseudohylesinus and Armellaria root-rot will be re-examined by Station personnel.

1/ Wright, E., Coulter, W. K., and Gruenfeld, J. J. 1956. Deterioration of beetle-killed Pacific silver fir. Jour. Forestry 54: 322-325.

MISCELLANEOUS FOREST INSECTS

At intervals in the past, damage caused by several other species of forest insects, aside from that described in the preceding section, has been significant in the Pacific Northwest. Ground observations by many cooperating foresters, plus insect material submitted for identification by private landowners and others, furnish valuable information on insect populations too light for recognition from the air. During 1956 aerial observations of certain light infestations may have been masked in parts of western Oregon and Washington by foliage damage from the November 1955 "deep freeze" and in eastern Oregon by extensive, although spotty, bud-killing caused by late spring frosts.

A summary of available information on 8 species of miscellaneous forest insects is presented in table 7. None of the species recorded in the table caused damage of economic importance in 1956. Some periodically destructive insects such as the hemlock looper, Lambdina fiscellaria lugubrosa Hulst, pandora moth, Coloradia pandora Blake, and spruce aphid, Neomyzaphis abietina (Wlkr.), were not reported during the year.

OTHER PEST PROBLEMS IN 1956

BEAR DAMAGE

Bear damage in western Oregon and western Washington forests, which consists of killing or wounding trees, has been severe since 1951. Such damage occurs in the early spring, when the animals claw the bark to feed on the cambium of young conifers, particularly Douglas-fir. Most serious damage has been observed in stands already understocked.

The incidence of tree-killing by bears has been recorded in the regional aerial survey since 1951. Losses have increased steadily since 1952 (fig. 2).

Typical bear damage

Table 7.--Record of the occurrence of other forest insects in 1956

Insect	Host	Locality	Degree of infestation
Black-headed budworm *Acleris variana* (Fem.)	Subalpine fir	Umatilla N.F.--Ridge traversed by Tollgate-Troy Rd.	Very light. Larvae or evidence of defoliation distributed throughout area.
Black pine leaf scale *Nuculaspis californica* (Coleman)	Ponderosa pine	Chelan Co. Wash.--Cashmere-Dryden area	Attacks on ponderosa pine adjoining orchards continued to be severe.
Douglas-fir needle miner *Contarinia* sp.	Douglas-fir	Blue Mountains, Oreg.	Very light. Infestation considerably below level observed in 1955 due to heavy parasitism.
Douglas-fir tussock moth *Hemerocampa pseudotsugata* McD.	Douglas-fir	Wallowa-Whitman N.F.--Bald Ridge area	Very light. Larvae recovered in light numbers.
Pine butterfly *Neophasia menapia* (Feld.)	Ponderosa pine Douglas-fir	Wallowa-Whitman N.F.--Bald Ridge area Lane Co., Oreg.--Mohawk Riv. Oreg. Caves Nat. Monument	Light defoliation noted but pupae appeared to be very scarce. Abnormal moth flights. Abnormal moth flights less than in 1955.
Pine sawflies *Neodiprion* spp.	Lodgepole & ponderosa pine	Oregon Cascades and Blue Mountains	Defoliation occurred only in very localized areas.
Sitka spruce weevil *Pissodes sitchensis* Hopk.	Sitka spruce	Olympic National Park--west side	Continuing to deform tops in young stands.
Spruce mealybug *Puto* sp.	Subalpine fir	Olympic National Park--Deer Park area	Attacks greatly reduced from epidemic levels observed in 1954.

New bear damage in the spring of 1956 totalled 444,140 acres. As shown in table 8, the forests of northwestern Washington suffered the bulk (46.4 percent) of the 1956 tree-killing.

Control of bears will be necessary to prevent further heavy losses in stands already badly depleted. Several bear control projects have been undertaken by the U. S. Fish and Wildlife Service in cooperation with landowners in the region. These projects have shown that bear hunting by sportsmen has been limited, that professional trappers have been most effective in the control of depredations and that trapping of three or four animals in a drainage will help alleviate the problem. On one cooperative project in Polk County, Oregon, 48 bear were trapped.

Figure 2.--Trend of bear damage in Oregon and Washington forests, 1951-56

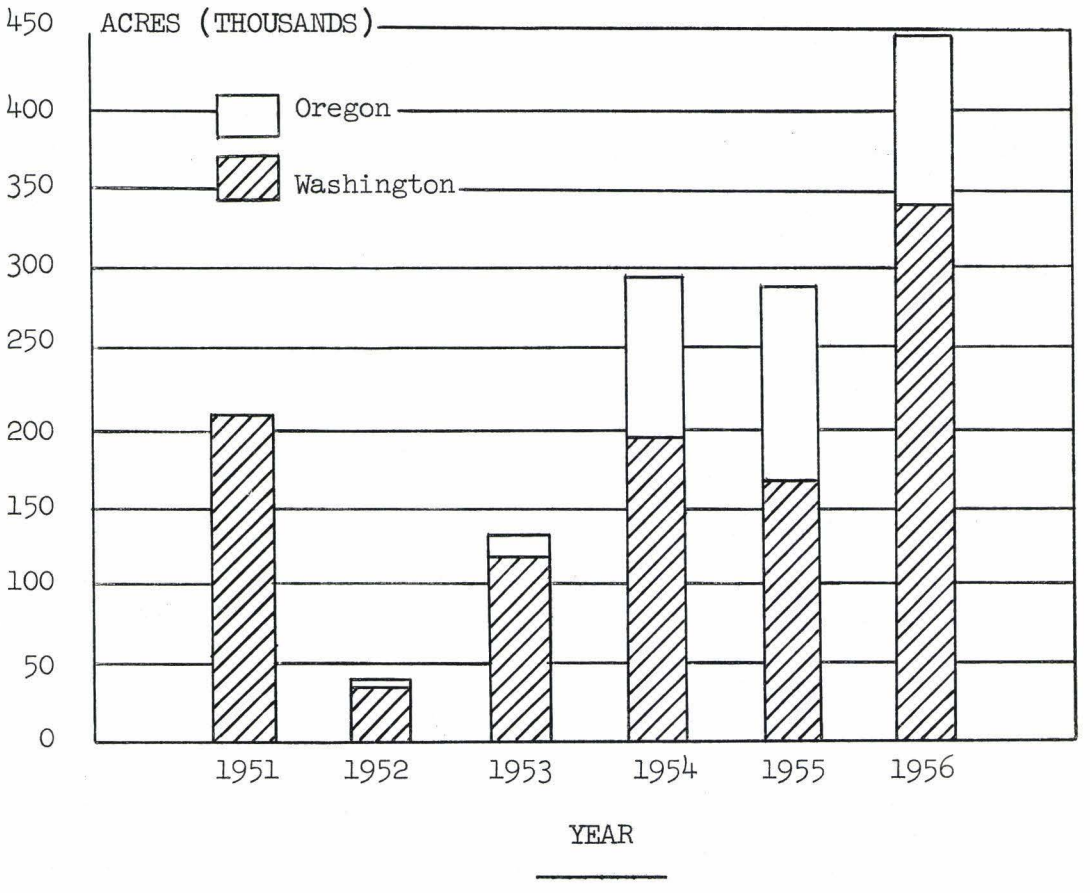


Table 8.--Intensity of bear damage in 1956, by administrative areas 1/

Administrative areas	Centers of damage	Intensity of damage				Total damage
		Light	Moderate	Heavy	Very heavy	
	No.	Acres	Acres	Acres	Acres	Acres
Oregon						
N.W. Oregon	31	7,260	39,580	20,060	960	67,860
Mt. Hood N.F.	8	480	9,560	1,120	0	11,160
Siuslaw N.F.	16	6,080	3,520	2,240	0	11,840
Willamette N.F.	14	7,400	1,760	120	0	9,280
Oregon areas	69	21,220	54,420	23,540	960	100,140
Washington						
G. Pinchot N.F.	4	0	32,260	19,360	0	51,620
N.W. Washington	61	75,040	117,680	13,760	20	206,500
S.W. Washington	3	80,000	4,000	0	0	84,000
Snoqualmie N.F.	2	1,560	0	0	0	1,560
Wenatchee N.F.	4	0	320	0	0	320
Washington areas	74	156,600	154,260	33,120	20	344,000
All areas	143	177,820	208,680	56,660	980	444,140

1/ Areas include damage on federal, private and state lands.

DYING HEMLOCK

Mortality of western hemlock from unknown causes has been recorded in each regional survey since 1954, but ground checks in the centers of damage have indicated that insects were not primarily responsible. Suggestions about the cause of mortality include: (1) overmaturity of the stands, (2) variations in normal climatic conditions, (3) excessive exposure due to unusual amounts of stand openings by logging, and (4) an unusual abundance of a pathogen.

In 1956 dying hemlock was found on 125,960 acres, mostly in western Washington, compared with about 68,800 acres in 1955. The current mortality was quite variable, increasing in some stands and decreasing in others. As shown in table 9 most of the damage was in southwestern Washington.

Salvage of the dead and dying trees is the only action that can be recommended.

Table 9.--Intensity of hemlock damage in 1956, by administrative areas 1/

Administrative areas	Damage centers	Intensity of damage: Light	Moderate	Heavy	Very heavy	Total damage
	No.	Acres	Acres	Acres	Acres	Acres
Oregon						
Mt. Hood N.F.	2	640	0	0	0	640
Siuslaw N.F.	3	1,440	0	0	0	1,440
N. W. Oregon	3	1,440	0	0	0	1,440
Oregon areas	8	3,520	0	0	0	3,520
Washington						
Mt. Baker N.F.	28	9,400	8,800	0	0	18,200
Olympic N.F.	36	21,860	5,280	0	0	27,140
Snoqualmie N.F.	4	1,440	0	880	0	2,240
Olympic N.P.	14	4,560	2,940	0	0	7,500
S. W. Washington	8	36,000	3,200	27,840	320	92,960
Washington areas	90	73,260	20,220	28,640	320	122,440
All areas	98	76,780	20,220	28,640	320	125,960

1/ Areas include damage on federal, private and state lands.

ORGANIZATION AND CONDUCT OF SURVEYS

Surveys to detect and appraise 1956 forest insect conditions in the Pacific Northwest were accomplished through the cooperative efforts of many persons. Grateful acknowledgement is hereby made to all who participated in this important program.

Aerial surveys - Aerial surveys were again organized and conducted under the able leadership of Mr. W. J. Buckhorn. A total of 305.4 hours of flying time (table 10) during the period July 9-August 28 and six combinations of survey personnel were required to complete the surveys.

Table 10.--Summary of 1956 cooperative aerial survey activities

Subregion	Timbered area surveyed	Air coverage	Mapping time	Ferry time	Total flying time
	Acres	Miles	Hours	Hours	Hours
Western Oregon	15,670,000	9,770	79.8	12.6	92.4
Eastern Oregon Cascades	6,591,000	5,710	42.8	12.6	55.4
Blue Mountains	6,964,000	3,990	34.9	5.0	39.9
Eastern Washington	7,148,000	4,030	30.7	1.5	32.2
Western Washington	11,774,000	9,630	75.7	9.8	85.5
All areas	48,147,000	33,130	263.9	41.5	305.4

Many agencies cooperated in the aerial phase of the survey.

The Oregon State Board of Forestry provided the services of Mr. A. T. Larsen, pilot, and the State Cessna 170-B plane for 70 hours of survey time in Oregon. In addition, the State contracted with the Station for rental of the State plane for 50.3 hours and furnished the pilot to complete the Oregon surveys.

The Washington State Division of Forestry provided a forester, Mr. K. Turnbull, to be trained as a permanent aerial observer for surveys in that state. He was trained by Mr. Buckhorn and accompanied him during 75.4 hours of surveys in Washington.

The Weyerhaeuser Timber Company again provided their Cessna 170-B and the services of Mr. P. G. Lauterbach, observer, and Mr. C. R. Dunbar, pilot, for 70 hours of surveys on branch forests as part of the cooperative agreement. As in past years, the findings were turned over to the Station for inclusion in the regional summary. In addition, 40 hours were flown to detect any sizeable areas of windthrown trees on the branch forests.

The Station contracted with Skyways, Inc. for 103.1 hours of flying. The company was low bidder on a request for the services of a Cessna 180 and pilot and furnished a nearly new plane and Mr. R. Alexander, pilot for surveys in most of Washington and a portion of Oregon. Messrs. W. J. Buckhorn and P. W. Orr were observers for the Station and J. F. Wear piloted the Station's Cessna 170-B during 12 hours of flying to detect hemlock looper damage. Infestations of the balsam woolly aphid received special attention in 1956. A detailed survey of the Gifford Pinchot N. F. and the fir stands in the Oregon Cascade Mountains was made during the Station's operation. Infestations on the Gifford Pinchot N. F. were plotted on a 1/2-inch-per-mile map and turned over to the Supervisor for planning salvage operations.

Ground Surveys - Several types of ground surveys or observations of insect damage were conducted in 1956.

Personnel of the Division of Forest Insect Research ground checked the aerial survey findings and provided information on light infestations of several potentially serious insects. A three-man crew composed of either Messrs. J. Ackerman, D. Costello, D. Henninger, D. Wagstaff or G. Walthall recruised the regional 320-acre pine beetle plots and re-examined the spruce budworm ground plots on the Mount Hood and Willamette National Forests and Warm Springs Indian Reservation.

Members of the Silver Fir Beetle Committee re-examined 296 plots established in 1954 to follow the trend of the silver fir beetle epidemic in northwestern Washington. A complete report of the Committee activities in 1956 was given at the annual meeting of the Pest Action Council.

In response to the Western Pine Association's annual request for statements of insect damage from its members, the Station received 10 reports. Addtional reports were received from personnel of the Bureau of Indian Affairs, Bureau of Land Management, Forest Service, National Park Service, and foresters of private companies.

Material submitted for identification by private and public landowners and managers also provided information on localized insect populations.

Table 11.--Insect-caused damage in forested areas of Oregon in 1956, by species and intensities

Forest areas	Insects	Infestation centers	Infestations by intensities: Light	Moderate	Heavy	Very heavy	Total
		No.	Acres	Acres	Acres	Acres	Acres
Deschutes N. F. and adjacent forest lands	Balsam woolly aphid	12	960	1,320	2,240	960	5,480
	Douglas-fir beetle	1	80	0	0	0	80
	Mountain pine beetle (L) 1/	19	4,040	4,320	4,320	0	12,680
	Mountain pine beetle (P)	1	640	0	0	0	640
	Oregon pine ips	5	40	920	0	0	960
	Western pine beetle	13	2,460	0	0	0	2,460
	All insects	51	8,220	6,560	6,560	960	22,300
Fremont N. F. and adjacent forest lands	Fir engraver	1	160	0	0	0	160
	Mountain pine beetle (L)	16	10,700	1,760	640	0	13,100
	Mountain pine beetle (P)	2	240	0	0	0	240
	Oregon pine ips	8	480	1,520	0	0	2,000
	Western pine beetle	7	2,400	0	0	0	2,400
	All insects	34	13,980	3,280	640	0	17,900

1/ Mountain pine beetle damage has been separated by tree species attacked: L = lodgepole pine; P = ponderosa pine; W = western white pine.

Table 11. (Continued)

Forest areas	Insects	Infestation centers	Infestations by intensities: Light	Moderate	Heavy	Very heavy	Total
		No.	Acres	Acres	Acres	Acres	
Malheur N.F. and adjacent forest lands	Mountain pine beetle (L)	5	0	960	3,360	1,280	5,600
	Oregon pine ips	36	1,280	4,960	4,960	1,920	13,120
	Spruce budworm	45	209,520	19,460		0	228,980
	Western pine beetle	3	960	0	0	0	960
	All insects	89	211,760	25,380	8,320	3,200	248,660
Mt. Hood N.F. and adjacent forest lands	Balsam woolly aphid	45	10,120	9,820	2,660	320	22,920
	Douglas-fir beetle	6	1,240	0	0	0	1,240
	Mountain pine beetle (W)	23	17,740	2,720	120	0	20,580
	Oregon pine ips	8	1,280	480	800	0	2,560
	Western pine beetle	4	650	0	0	0	650
	All insects	86	31,030	13,020	3,580	320	47,950
Ochoco N. F. and adjacent forest lands	Spruce budworm	9	19,360	840	0	0	20,200
	Oregon pine ips	39	2,240	6,400	1,280	1,440	11,360
	Western pine beetle	5	960	0	0	0	960
	All insects	53	22,560	7,240	1,280	1,440	32,520

Table 11. (Continued)

Forest Area	Insects	Infestation centers	Infestations by intensities: Light	Moderate	Heavy	Very heavy	Total
		No.	Acres	Acres	Acres	Acres	Acres
Rogue River N.F. and adjacent forest lands	Douglas-fir beetle	12	2,650	0	0	0	2,650
	Fir engraver	2	40	160	0	0	200
	Mountain pine beetle (L)	8	4,000	3,360	960	160	8,480
	Mountain pine beetle (P)	4	1,120	160	0	0	1,280
	Oregon pine ips	17	500	1,500	400	0	2,400
	Western pine beetle	23	4,210	340	20	0	4,570
	All insects	66	12,520	5,520	1,380	160	19,580
Siskiyou N.F. and adjacent forest lands	Douglas-fir beetle	19	3,340	320	0	0	3,660
	Western pine beetle	1	160	0	0	0	160
	All insects	20	3,500	320	0	0	3,820
Siuslaw N.F. and adjacent forest lands	Balsam woolly aphid	18	7,360	3,680	2,560	3,360	16,960
	Douglas-fir beetle	46	3,320	80	0	0	3,400
	Mountain pine beetle	1	160	0	0	0	160
	All insects	65	10,840	3,760	2,560	3,360	20,520

Table 11. (Continued)

Forest area	Insects	Infestation centers	Infestations by intensites: Light	Moderate	Heavy	Very heavy	Total
		No.	Acres	Acres	Acres	Acres	Acres
Umatilla N. F. and adjacent forest lands	Douglas-fir beetle	10	1,560	0	0	0	1,560
	Engelmann spruce beetle	4	600	800	0	0	1,400
	Fir engraver	25	3,240	5,040	320	0	8,600
	Mountain pine beetle (L)	3	160	640	160	0	960
	Oregon pine ips	42	3,040	3,800	1,320	0	8,160
	Spruce budworm	14	25,600	23,680	3,280	0	52,560
	All insects	98	34,200	33,960	5,080	0	73,240
Umpqua N.F. and adjacent forest lands	Balsam woolly aphid	3	360	0	0	0	360
	Douglas-fir beetle	5	300	0	0	0	300
	Fir engraver	4	100	360	0	0	460
	Mountain pine beetle (L)	1	160	0	0	0	160
	Mountain pine beetle (P)	1	0	960	0	0	960
	Mountain pine beetle (W)	3	400	0	0	0	400
	Western pine beetle	2	80	0	0	0	80
	All insects	19	1,400	1,320	0	0	2,720
Wallowa-Whitman N.F. and adjacent forest lands	Douglas-fir beetle	13	1,760	800	320	2,080	4,960
	Engelmann spruce beetle	20	1,920	3,200	2,720	0	7,840
	Fir engraver	25	8,160	1,280	320	0	9,760
	Mountain pine beetle (L)	11	1,280	4,000	320	0	5,600
	Mountain pine beetle (P)	4	160	3,200	0	0	3,360
	Oregon pine ips	87	15,200	12,640	7,200	2,240	37,280
	Spruce budworm	81	212,700	19,560	0	0	232,260
	All insects	241	241,180	44,680	10,880	4,320	301,060

Table 11. (Continued)

Forest areas	Insects	Infestation centers	Infestations by intensities: Light	Moderate	Heavy	Very heavy	Total
		No.	Acres	Acres	Acres	Acres	Acres
Willamette N. F. and adjacent forest lands	Balsam woolly aphid	96	39,240	25,430	39,580	1,600	105,850
	Douglas-fir beetle	1	160	0	0	0	160
	Engelmann spruce beetle	1	1,920	0	0	0	1,920
	Fir engraver	1	0	0	20	0	20
	Mountain pine beetle (L)	3	320	80	0	0	400
	Mountain pine beetle (W)	47	10,780	2,680	80	0	13,540
	All insects	149	52,420	28,190	39,680	1,600	121,890
Crater Lake National Park	Mountain pine beetle (L)	2	320	960	0	0	1,280
Klamath Indian Reservation	Oregon pine ips	3	240	480	0	0	720
	Mountain pine beetle (L)	10	3,200	960	0	0	4,160
	Mountain pine beetle (P)	1	960	0	0	0	960
	Western pine beetle	3	1,680	0	0	0	1,680
	All insects	17	6,080	1,440	0	0	7,520
Umatilla Indian Reservation	Oregon pine ips	1	80	0	0	0	80
Warm Springs Indian Reservation	Balsam woolly aphid	1	480	0	0	0	480
	Douglas-fir beetle	3	1,240	0	0	0	1,240
	Oregon pine ips	4	400	640	160	0	1,200
	All insects	8	2,120	640	160	0	2,920

Table 11. (Continued)

Forest areas	Insects	Infestation centers	Infestations by intensities: Light	Moderate	Heavy	Very heavy	Total
		No.	Acres	Acres	Acres	Acres	Acres
Central Oregon District (O.S.B.F.)	Oregon pine ips	15	1,120	640	1,120	0	2,880
Coos Bay District (O.S.B.F.)	Douglas-fir beetle	4	1,520	0	0	0	1,520
Northwest Oregon District (O.S.B.F.)	Balsam woolly aphid	1	160	0	0	0	160
Lookout Mt. (B.L.M.)	Spruce budworm	16	0	120	2,000	0	2,120
All areas	Balsam woolly aphid	176	58,680	40,250	47,040	6,240	152,210
	Douglas-fir beetle	120	17,170	1,200	320	2,080	20,770
	Engelmann spruce beetle	25	4,440	4,000	2,720	0	11,160
	Fir engraver	58	11,700	6,840	660	0	19,200
	Mountain pine beetle (L)	77	24,180	17,040	9,760	1,440	52,420
	Mountain pine beetle (P)	13	3,120	4,320	0	0	7,440
	Mountain pine beetle (W)	74	29,080	5,400	200	0	34,680
	Oregon pine ips	266	25,900	33,980	17,240	5,600	82,720
	Spruce budworm	165	467,180	63,660	5,280	0	536,120
	Western pine beetle	60	13,560	340	20	0	13,920
All insects		1,034	655,010	177,030	83,240	15,360	930,640

Table 12.--Insect-caused damage in forested areas of Washington 1/ in 1956, by species and intensities

Forest areas	Insects	Infestation centers	Infestations by intensities: Light	Moderate	Heavy	Very heavy	Total
		No.	Acres	Acres	Acres	Acres	Acres
Gifford Pinchot N.F. and adjacent forest lands	Balsam woolly aphid	205	63,040	43,040	45,760	21,420	173,260
	Mountain pine beetle (W) 2/	57	13,440	25,600	27,680	4,320	71,040
	All insects	262	76,480	68,640	73,440	25,740	224,300
Mt. Baker N.F. and adjacent forest lands	Balsam woolly aphid	1	640	0	0	0	640
	Mountain pine beetle (W)	54	11,940	8,640	4,320	0	24,900
	All insects	55	12,580	8,640	4,320	0	25,540
Okanogan N.F. and adjacent forest lands	Douglas-fir beetle	46	9,920	7,040	0	0	16,960
	Mountain pine beetle (L)	9	2,400	960	0	0	3,360
	Oregon pine ips	14	800	640	0	0	1,440
	Western pine beetle	5	1,200	320	0	0	1,520
	All insects	74	14,320	8,960	0	0	23,280
Olympic N.F. and adjacent forest lands	Mountain pine beetle (W)	21	2,240	3,120	840	0	6,200

1/ Includes the Colville and Spokane Indian Reservations but excludes the remaining portions of Ferry and Stevens Counties and Pend Orielle, Spokane, Lincoln and Whitman Counties.

2/ Mountain pine pine beetle damage has been separated by tree species attacked: W = western white pine; L = lodgepole pine.

Table 12. (Continued)

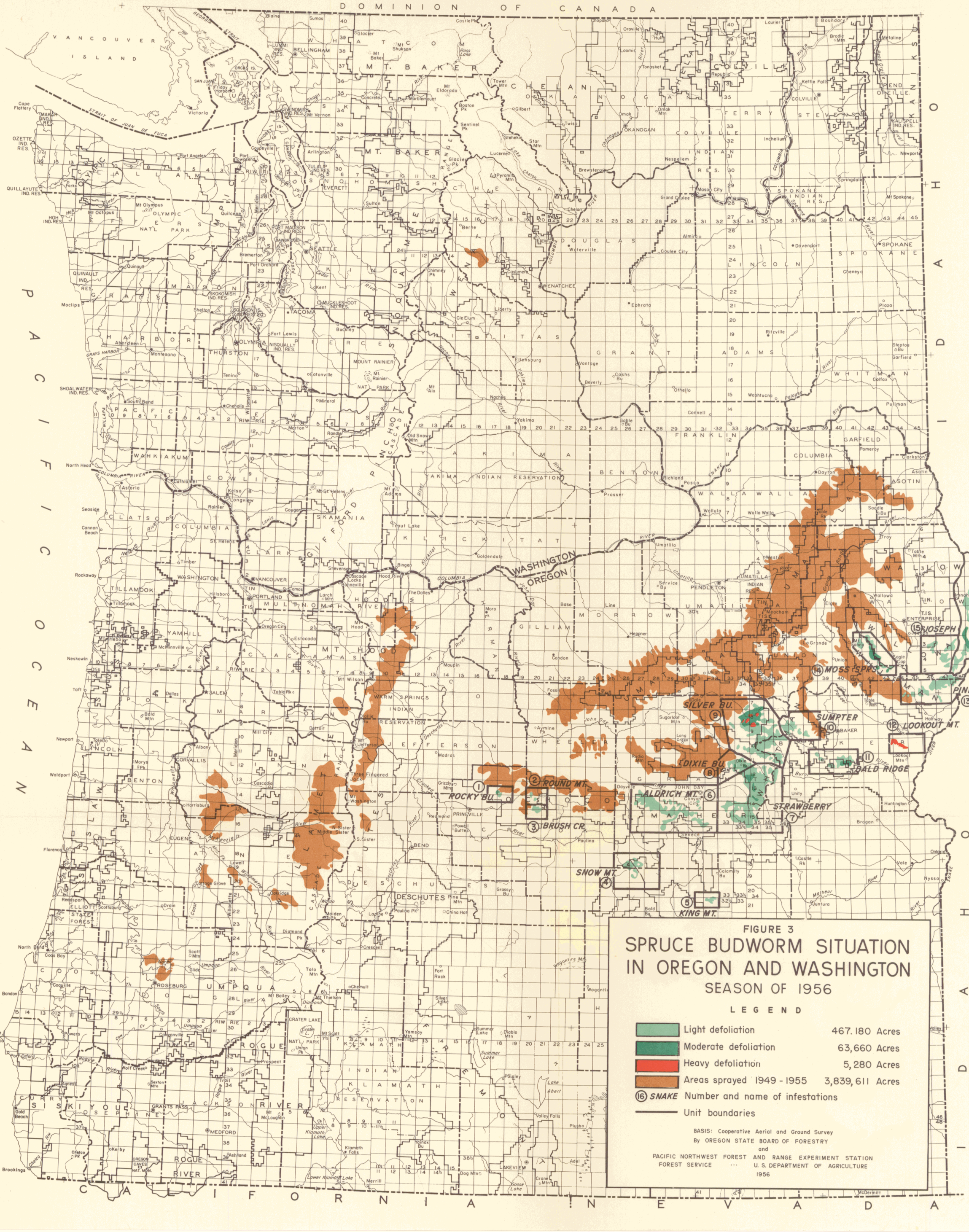
Forest areas	Insects	Infestation centers	Infestation by intensities: Light	Moderate	Heavy	Very heavy	Total
		No.	Acres	Acres	Acres	Acres	Acres
Snoqualmie N.F. and adjacent forest lands	Balsam woolly aphid	3	0	0	2,040	1,920	3,960
	Douglas-fir beetle	14	1,200	1,920	320	0	3,440
	Engelmann spruce beetle	10	2,920	0	0	0	2,920
	Fir engraver	4	1,200	960	0	0	2,160
	Larch budworm	1	800	0	0	0	800
	Mountain pine beetle (L)	7	1,760	480	0	0	2,240
	Mountain pine beetle (W)	37	11,100	5,160	480	0	16,740
	All insects	76	18,980	8,520	2,840	1,920	32,260
Wenatchee N.F. and adjacent forest lands	Douglas-fir beetle	25	5,280	0	0	0	5,280
	Engelmann spruce beetle	3	800	0	0	0	800
	Fir engraver	4	640	1,440	0	0	2,080
	Mountain pine beetle (L)	41	5,760	10,240	4,480	0	20,480
	Mountain pine beetle (W)	13	800	1,280	1,760	480	4,320
	Oregon pine ips	4	100	1,280	1,600	0	2,980
	All insects	90	13,380	14,240	7,840	480	35,940
Umatilla N.F. and adjacent forest lands	Douglas-fir beetle	1	160	0	0	0	160
	Fir engraver	4	1,280	160	0	0	1,440
	Oregon pine ips	13	1,120	1,760	0	0	2,880
	Western pine beetle	1	320	0	0	0	320
	All insects	19	2,880	1,920	0	0	4,800

Table 12. (Continued)

Forest areas	Insects	Infestation centers	Infestation by intensities: Light	Moderate	Heavy	Very heavy	Total
		No.	Acres	Acres	Acres	Acres	Acres
Colville Indian Reservation	Douglas-fir beetle	107	24,660	28,760	12,440	680	66,540
	Larch budworm	2	280	0	0	0	280
	Mountain pine beetle (L)	4	0	440	80	0	520
	Oregon pine ips	3	20	120	0	0	140
	Western pine beetle	2	80	0	0	0	80
	All insects	118	25,040	29,320	12,520	680	67,560
Quinault Indian Reservation	Mountain pine beetle (W)	4	1,600	0	0	0	1,600
Spokane Indian Reservation	Douglas-fir beetle	3	150	3,160	0	0	3,310
	Oregon pine ips	4	30	30	0	0	60
	Western pine beetle	2	140	10	0	0	150
	All insects	9	320	3,200	0	0	3,520
Yakima Indian Reservation	Douglas-fir beetle	1	0	320	0	0	320
	Mountain pine beetle (L)	3	480	960	0	0	1,440
	All insects	4	480	1,280	0	0	1,760
Olympic National Park	Balsam woolly aphid	1	160	0	0	0	160
	Fir engraver	1	0	80	0	0	80
	Mountain pine beetle (W)	11	880	1,440	320	0	2,640
	All insects	13	1,040	1,520	320	0	2,880

Table 12. (Continued)

Forest areas	Insects	Infestation centers	Infestation by intensities: Light	Moderate	Heavy	Very heavy	Total
		No.	Acres	Acres	Acres	Acres	Acres
Mount Rainier National Park	Balsam woolly aphid	2	160	0	0	0	160
	Mountain pine beetle (W)	4	2,260	480	0	0	2,740
	All insects	6	2,420	480	0	0	2,900
Glenwood District (W.S.D.F.)	Douglas-fir beetle	1	0	120	0	0	120
	Oregon pine ips	20	0	320	1,400	0	1,720
	Western pine beetle	1	40	0	0	0	40
	All insects	22	40	440	1,400	0	1,880
Southwest Washington (W.S.D.F.)	Balsam woolly aphid	4	23,840	1,760	0	0	25,600
All areas	Balsam woolly aphid	216	87,840	44,800	47,800	23,340	203,780
	Douglas-fir beetle	198	41,370	41,320	12,760	680	96,130
	Engelmann spruce beetle	13	3,720	0	0	0	3,720
	Fir engraver	13	3,120	2,640	0	0	5,760
	Larch budworm	3	1,080	0	0	0	1,080
	Mountain pine beetle (L)	64	10,400	13,080	4,560	0	28,040
	Mountain pine beetle (W)	181	44,260	45,720	35,400	4,800	130,180
	Oregon pine ips	58	2,070	4,150	3,000	0	9,220
	Western pine beetle	11	1,780	330	0	0	2,110
All insects		757	195,640	152,040	103,520	28,820	480,020


DOMINION OF CANADA
PACIFIC OCEAN
IDAHO
CALIFORNIA
NEVADA
WASHINGTON
OREGON
VANCOUVER ISLAND
STRAIT OF JUAN DE FUCA
GEORGIA STRAIT
M. T. BAKER
MT. BAKER
OLYMPIC NAT'L PARK
MOUNT RAINIER NAT'L PARK
CRATER LAKE NAT'L PARK
YAKIMA INDIAN RESERVATION
WARM SPRINGS INDIAN RESERVATION
KLAMATH INDIAN RESERVATION
SPOKANE INDIAN RES.
COLVILLE INDIAN RES.
NESPELEM INDIAN RES.
UMATILLA INDIAN RES.
PENDLETON
WENATCHEE
YAKIMA
ROSEBURG
MEDFORD
KLAMATH FALLS
BELLINGHAM
SEATTLE
TACOMA
OLYMPIA
VANCOUVER
PORTLAND
SALEM
EUGENE
BEND
PRINEVILLE
LAKEVIEW
SPOKANE
COLVILLE
OKANOGAN
1 ROCKY BU.
2 ROUND MT.
3 BRUSH CR.
4 SNOW MT.
5 KING MT.
6 ALDRICH MT.
7 STRAWBERRY
8 DIXIE BU.
9 SILVER BU.
10 SUMPTER
11 BALD RIDGE
12 LOOKOUT MT.
13 PINE CR.
14 MOSS SPRS.
15 JOSEPH
16 SNAKE
FIGURE 3
SPRUCE BUDWORM SITUATION
IN OREGON AND WASHINGTON
SEASON OF 1956
LEGEND
Light defoliation 467.180 Acres
Moderate defoliation 63,660 Acres
Heavy defoliation 5,280 Acres
Areas sprayed 1949 - 1955 3,839,611 Acres
(16) SNAKE Number and name of infestations
Unit boundaries
BASIS: Cooperative Aerial and Ground Survey
By OREGON STATE BOARD OF FORESTRY
and
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
FOREST SERVICE ... U. S. DEPARTMENT OF AGRICULTURE
1956

DOMINION OF CANADA

FIGURE 4

GENERALIZED AREAS OF FOREST INSECT EPIDEMICS IN OREGON AND WASHINGTON OTHER THAN SPRUCE BUDWORM

SEASON OF 1956

LEGEND

Balsam woolly aphid	355,990 Acres
Mountain pine beetle	252,760 Acres
Douglas – fir beetle	116,900 Acres
Oregon pine engraver beetle	91,940 Acres

BASIS: Cooperative Aerial and Ground Survey
by OREGON STATE BOARD OF FORESTRY
WEYERHAEUSER TIMBER COMPANY
and
PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
FOREST SERVICE U. S. DEPARTMENT OF AGRICULTURE
1956

WASHINGTON
OREGON